Resonantly enhanced second harmonic generation in GaN-based photonic crystal slabs

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There is a major interest in fabricating III-nitride photonic structures for efficient non-linear optical processes such as second-harmonic generation because they offer fairly large non linear coefficients and high optical damage thresholds. However, the use of III-nitrides has not been possible practically due to the high dispersion and the small birefringence for phase-matching. Recently, we have shown experimentally the enhancement of second-harmonic generation in epitaxial GaN-based photonic crystals [1]. By using calculated and experimental equifrequency surfaces, it is possible to identify the geometrical configurations that will allow quasi-phase matching to be satisfied and observed experimentally in the available wavelength tuning range of the laser. The second-harmonic field generated has been measured in reflection from the surface of photonic crystals etched into a GaN layer. A very large second-harmonic enhancement is observed when simultaneously the incident beam at the fundamental frequency ω excites a resonant Bloch mode and the second-harmonic field generated is coupled into a resonant Bloch mode at 2ω.

[1] J. Torres, D. Coquillat, R. Legros, J.P. Lascaray, F. Teppe, D. Scalbert, D. Peyrade, Y. Chen, O. Briot, M. Le Vassor d'Yerville, E. Centeno, D. Cassagne, and J.P. Albert, *Phys. Rev. B*, **69**, 085105 (2004).